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TEN NEW SPECIES OF *MYRMICA* (HYMENOPTERA, FORMICIDAE) FROM THE HIMALAYA

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Ten New Species of *Myrmica* (Hymenoptera, Formicidae) from the Himalaya. Radchenko A. G., Elmes G. W. — Ten new species discovered among collections examined in the course of a taxonomic revision of the *Myrmica* species of the Himalaya and the adjacent mountain regions of India and Pakistan are described: *Myrmica brancuccii, M. villosa, M. vittata, M. williamsi, M. nitida, M. wittmeri, M. wardi, M. ordinaria, M. rhytida* and *M. petita*. They belong to several quite different complexes of species of the genus *Myrmica*, but clearly differ from each other and all previously described forms. Distinctions of each species and data on their ecology are given.

Key words: Ants, Formicidae, *Myrmica*, new species, India, Pakistan.

Десять новых видов *Myrmica* (Hymenoptera, Formicidae) из Гималаев. Радченко А. Г., Элмс Г. В. — В статье приведено описание 10 новых для науки видов *Myrmica*, собранных в Гималаях и прилежащих горных системах Индии и Пакистана. Описаны: *Myrmica brancuccii, M. villosa, M. vittata, M. williamsi, M. nitida, M. wittmeri, M. wardi, M. ordinaria, M. rhytida* и *M. petita*. Они относятся к нескольким довольно различным комплексам видов рода *Myrmica*, и четко отличаются как друг от друга, так и от всех ранее описанных форм. Приведены отличия каждого нового вида от близких видов и все имеющиеся данные об их экологии.

Ключевые слова: муравьи, Formicidae, *Myrmica*, новые виды, Индия, Пакистан.

Introduction

The genus *Myrmica* has a Holarctic, temperate distribution and its colonies are abundant, often dominating, in a wide range of natural and semi-natural habitats. Currently, more than 160 species are recognised, of which about 25 originate from the Himalaya and the Tibetan plateau (Bolton 1995). The first *Myrmica* species recorded from the Himalayan region, was *Myrmica rugosa* Mayr (1865), but the majority were described in the early part of the twentieth century — *e. g.*, eight species by Forel (1902, 1904 a, b, 1906). Menozzi (1939) installed some order into the taxonomy of the Himalayan *Myrmica* species and provided a key. Weber added three new species to the list when he made a synopsis of the Palaearctic *Myrmica* as a part of his revision of the North American species (Weber, 1947, 1948, 1950). Since then, there has been no further treatment of the Himalayan *Myrmica* except for the description of a social parasite — *Myrmica ereptrix* Bolton (1988). Nevertheless, myrmecologists continued to collect ants from the Himalaya, particularly from the southern and western mountains of Pakistan, Nepal, India and Bhutan, and therefore a taxonomic revision of the *Myrmica* of those regions is overdue.

When we started a general revision of the Asian *Myrmica*, we were fortunate to be given access to several unidentified collections of Himalayan *Myrmica* (see below). Examination of these soon convinced us that the mountains of the southern and western sides of the Himalaya form a separate biogeographic zone for *Myrmica* species, which are quite distinct from the fauna of the northern and eastern mountains, including the Tibetan plateau. Among the collections we discovered 15 previously unknown species which clearly differ from all the previously described forms. Five of them belong to the *ritae* group — a distinct group of primitive *Myrmica* species — which we described when revising that group (Radchenko, Elmes, 1998). It should be noted that the remaining 10 species have no particular taxonomic affinity to each other, they belong to various complexes existing within the Himalayan *Myrmica*. Here we describe formally these 10 species, prior to their inclusion in a full taxonomic revision of the south-western Himalayan *Myrmica* (in preparation).

Material and methods

This paper is based on the study of unidentified material from Naturhistorisches Museum, Basle (NHMB), The Natural History Museum, London (NHML), Philip Ward, University of California, USA (WARD), Fabrizio Rigato, University of Milan (RIGATO). It has been compared with type specimens and other specimens from the Museum of Comparative Zoology of Harvard University (MCZ), Museum d'Histoire Naturelle, Geneva (GENEVA), Institute of Zoology of Ukrainian National Academy of Sciences, Kiev (KIEV), Museo Civico di Storia Naturale, Genoa (MSNG), Zoological Museums of Moscow State University (ZMUM), Zoologisches Museum, Humboldt Universität, Berlin (ZMHB), Zoological Institute of Russian Academy of Sciences, St. — Petersburg (ZISP), The Hope Collections, University Museum, Oxford (UMO) and from the collections of Graham Elmes, Institute of Terrestrial Ecology, UK (ELMES), Maurizio Mei, Instituto di Zoologia, Roma (MEI), Cedric Collingwood, Leeds, UK (CAC) and Andreas Schulz, Leilingen, Germany (SCHULZ).

As previously (Radchenko, Elmes, 1998), we have made the following measurements on the type specimens and where possible a minimum sample of 15 specimens from other series, and used them to calculate a series of indices:

Measurements:

HL	length of head in dorsal view, measured in a straight line from the anterior point of median clypeal margin to mid-point of the occipital margin.
HW	maximum width of head in dorsal view behind the eyes.
FW	minimum width of frons between the frontal lobes.
FLW	maximum width between external borders of the frontal lobes.
SL	maximum straight-line length of antennal scape seen in profile.
AL	diagonal length of the alitrunk seen in profile, from the neck shield to the posterior margin of metapleural lobes (workers) and from the antero-dorsal point of alitrunk to posterior margin of metapleural lobes (females and males).
HTL	length of tibia of hind leg.
PNW	maximum width of pronotum from above in dorsal view (workers)
SCW	maximum width of scutum from above (females and males).
SCL	length of scutum + scutellum from above (females and males).
AH	height of alitrunk, measured from upper level of mesonotum perpendicularly to the level of lower margin of mesopleura (females and males).
PL	maximum length of petiole from above.
PPL	maximum length of postpetiole from above.
PW	maximum width of petiole from above.
PPW	maximum width of postpetiole from above.
PH	maximum height of petiole in profile.
PPH	maximum height of postpetiole in profile.
ESL	maximum length of propodeal spine in profile.
ESD	distance between tips of propodeal spine from above.
WL	maximum length of forewing (males and females).
WB	maximum breadth of forewing (males and females).

Indices:

Cephalic	CI = HL / HW	Post-petiole (2)	PPI2 = PPH / PPW
Frontal	FI = FW / HW	Post-petiole (3)	PPI3 = PPW / PW
Frontal-lobe	FLI = FLW / FW	Spine-length	ESLI = ESL / HW
Scape (1)	SI1 = SL / HL	Spine-width	ESDI = ESD / ESL
Scape (2)	SI2 = SL / HW	Alitrunk	AI = AL / AH
Petiole (1)	PI1 = PL / PH	Hind-tibia	HTI = HTL / HW
Petiole (2)	PI2 = PL / HW	Scutum	SCI = SCL / SCW
Post-petiole (1)	PPI1 = PPL / PPH	Wing-length (1)	WI1 = WL / HW
		Wing-length (2)	WI2 = WL / WB

Results

The morphometrics made on the holotypes of the new species can be found in table 1 (workers) and table 4 (queen); the morphometrics of 15 specimens (or as many as were available) are given in table 2 (workers) and table 4 (gynes and males), and the various indices calculated from these for tables 3 and 5. All the new species have the

following features in common. The workers and queens have oval, convex eyes that are situated slightly anterior to the mid points of the sides of the head. The frons is relatively wide (FI > 0.40, table 3). The antennal scapes are distinctly shorter than the length of the head (SI1 < 1; table 3); they are weakly curved at their bases (not angled) with no trace of a lobe. With three exceptions, the 3rd–5th funicular joints are relatively short (length < 1.5 breadth). The apical club is 4-jointed. The metapleural lobes are rounded and there are no ventral lobes on either the petiole or postpetiole. The middle and hind tibia have well-developed pectinate spurs. With one exception, the gaster is smooth and shiny. The males have relatively large, more rounded eyes situated anterior

Table 1. Measurements (mm — abbreviations as in text) of the holotypus specimens. All are workers except *M. petita*, for which: ALH = 0.94 mm and SCL = 1.16 mm. The source is the museum (see text) which currently holds the type specimen

Таблица 1. Промеры (мм — сокращения в тексте) голотипов. Все особи рабочие, за исключением *M. petita*, для которой: ALH = 0.94 мм and SCL = 1.16 мм. Графа "source" содержит аббревиатуру названия музея (см. текст) в котором хранится типовой экземпляр

Species		Source	HW	HL	FW	FLW	SL	PNW	PW	PPW	PH	PPH	PL	PPL	ESL	ESD	AL	HTL
M. brancuccii	w	NHML	1.00	1.28	0.42	0.43	1.00	0.72	0.26	0.46	0.35	0.49	0.45	0.34	0.36	0.51	1.68	1.04
M. villosa	w	NHMB	1.12	1.27	0.50	0.53	1.12	0.78	0.31	0.46	0.41	0.45	0.50	0.42	0.25	0.45	1.74	1.05
M. vittata	w	NHML	1.02	1.22	0.46	0.48	1.05	0.77	0.32	0.48	0.38	0.46	0.52	0.41	0.35	0.46	1.79	0.94
M. williamsi	w	NHML	0.71	0.92	0.31	0.34	0.73	0.53	0.22	0.32	0.28	0.31	0.35	0.29	0.13	0.28	1.20	0.69
M. nitida	w	NHML	0.76	0.97	0.34	0.36	0.74	0.55	0.22	0.31	0.26	0.31	0.35	0.28	0.15	0.29	1.30	0.71
M. wittmeri	w	NHML	0.77	0.99	0.33	0.34	0.74	0.56	0.21	0.33	0.28	0.32	0.36	0.29	0.14	0.27	1.27	0.70
M. wardi	w	NHML	0.85	1.06	0.39	0.41	0.84	0.63	0.24	0.39	0.31	0.38	0.41	0.33	0.20	0.34	1.44	0.78
M. ordinaria	w	NHML	0.84	1.06	0.36	0.38	0.86	0.62	0.24	0.38	0.31	0.37	0.43	0.30	0.21	0.32	1.56	0.82
M. rhytida	w	NHMB	0.88	1.11	0.38	0.41	0.88	0.66	0.25	0.39	0.31	0.36	0.41	0.36	0.27	0.38	1.46	0.76
M. petita	Q	NHMB	0.82	1.02	0.34	0.37	0.74	0.74	0.24	0.38	0.34	0.38	0.46	0.32	0.24	0.40	1.58	0.74

Table 2. The mean, standard deviation, minimum and maximum values (mm) of the measurements made on samples of workers (including Holotype) from eight new species of *Myrmica* from the Himalaya. The measurements codes are as indicated in the methods and the number of individuals measured are given in parenthesis

Таблица 2. Средняя величина, стандартное отклонение, минимальное и максимальное значение (мм) промеров, полученные на выборках рабочих (включая голотип) восьми новых видов *Myrmica* из Гималаев. Расшифровку сокращений промеров см. в разделе "Методы"; количество измеренных особей дано в скобках

	M. brancuccii (18)		*M. villosa* (14)		*M. vittata* (4)		*M. nitida* (21)	
	Mean±SD	Min–Max	Mean±SD	Min–Max	Mean±SD	Min–Max	Mean±SD	Min–Max
HW	0.99±0.081	0.83–1.12	1.09±0.053	0.95–1.13	0.91±0.127	0.73–1.02	0.78±0.027	0.74–0.83
HL	1.22±0.088	1.02–1.32	1.27±0.046	1.15–1.32	1.10±0.118	0.94–1.22	0.84±0.028	0.94–1.04
FW	0.42±0.031	0.36–0.48	0.50±0.025	0.43–0.53	0.41±0.041	0.36–0.46	0.35±0.011	0.33–0.38
FLW	0.45±0.033	0.38–0.51	0.52±0.028	0.43–0.55	0.44±0.047	0.37–0.48	0.37±0.012	0.34–0.39
SL	1.00±0.054	0.90–1.08	1.11±0.038	1.01–1.15	0.96±0.087	0.84–1.05	0.77±0.026	0.71–0.80
PNW	0.69±0.055	0.56–0.78	0.76±0.030	0.67–0.78	0.70±0.085	0.57–0.77	0.57±0.023	0.52–0.60
PW	0.28±0.029	0.22–0.33	0.29±0.018	0.27–0.32	0.28±0.035	0.23–0.32	0.22±0.008	0.21–0.24
PPW	0.46±0.044	0.38–0.53	0.44±0.025	0.39–0.48	0.44±0.056	0.34–0.48	0.32±0.014	0.30–0.34
PH	0.36±0.035	0.29–0.41	0.39±0.019	0.35–0.42	0.35±0.040	0.29–0.38	0.28±0.012	0.27–0.31
PPH	0.48±0.044	0.39–0.55	0.44±0.019	0.41–0.47	0.40±0.059	0.32–0.46	0.32±0.012	0.30–0.34
PL	0.44±0.038	0.36–0.51	0.48±0.027	0.43–0.52	0.50±0.055	0.42–0.55	0.36±0.018	0.32–0.39
PPL	0.35±0.028	0.27–0.38	0.40±0.019	0.36–0.42	0.35±0.046	0.29–0.41	0.43±0.012	0.27–0.32
ESL	0.37±0.038	0.28–0.43	0.28±0.024	0.24–0.32	0.31±0.051	0.24–0.35	0.15±0.017	0.11–0.17
ESD	0.45±0.048	0.38–0.53	0.49±0.041	0.41–0.56	0.41±0.052	0.34–0.46	0.31±0.017	0.28–0.34
AL	1.69±0.127	1.40–1.86	1.68±0.058	1.53–1.76	1.68±0.235	1.26–1.79	1.33±0.035	1.27–1.39
HTL	0.99±0.067	0.84–1.10	1.03±0.037	0.94–1.06	0.82±0.143	0.62–0.94	0.75±0.029	0.70–0.79

Table 2 (cont.)
Таблица 2 (продолжение)

	M. wittmeri (9)		*M. wardi* (18)		*M. ordinaria* (17)		*M. rhytida* (17)	
	Mean±SD	Min–Max	Mean±SD	Min–Max	Mean±SD	Min–Max	Mean±SD	Min–Max
HW	0.77±0.029	0.73–0.81	0.79±0.048	0.70–0.85	0.85±0.022	0.82–0.90	0.88±0.043	0.78–0.94
HL	0.99±0.030	0.94–1.04	1.00±0.051	0.90–1.06	1.06±0.026	1.00–1.10	1.09±0.0470	0.99–1.15
FW	0.34±0.019	0.32–0.38	0.34±0.024	0.31–0.39	0.38±0.014	0.35–0.40	0.37±0.019	0.34–0.40
FLW	0.35±0.011	0.34–0.36	0.36±0.025	0.32–0.41	0.39±0.015	0.37–0.42	0.39±0.020	0.36–0.42
SL	0.77±0.027	0.73–0.80	0.78±0.041	0.70–0.84	0.84±0.033	0.78–0.90	0.87±0.046	0.76–0.92
PNW	0.55±0.023	0.52–0.58	0.59±0.031	0.52–0.63	0.62±0.021	0.58–0.66	0.64±0.034	0.56–0.70
PW	0.22±0.007	0.21–0.22	0.22±0.012	0.20–0.24	0.24±0.005	0.23–0.24	0.24±0.010	0.22–0.26
PPW	0.32±0.011	0.31–0.34	0.33±0.024	0.30–0.39	0.37±0.009	0.36–0.39	0.36±0.019	0.34–0.39
PH	0.29±0.009	0.27–0.29	0.29±0.014	0.27–0.31	0.30±0.009	0.28–0.31	0.32±0.016	0.29–0.34
PPH	0.33±0.010	0.31–0.34	0.34±0.022	0.31–0.38	0.39±0.013	0.37–0.42	0.35±0.017	0.32–0.37
PL	0.36±0.017	0.32–0.38	0.36±0.031	0.31–0.41	0.41±0.021	0.36–0.44	0.40±0.021	0.36–0.45
PPL	0.30±0.014	0.28–0.32	0.31±0.016	0.28–0.34	0.30±0.023	0.26–0.35	0.35±0.015	0.32–0.37
ESL	0.16±0.018	0.14–0.20	0.19±0.033	0.14–0.28	0.23±0.014	0.21–0.26	0.23±0.028	0.18–0.27
ESD	0.29±0.019	0.25–0.31	0.31±0.023	0.27–0.35	0.33±0.018	0.30–0.36	0.36±0.021	0.33–0.41
AL	1.31±0.042	1.23–1.36	1.36±0.068	1.20–1.46	1.52±0.035	1.46–1.56	1.46±0.068	1.33–1.57
HTL	0.73±0.022	0.70–0.76	0.73±0.035	0.64–0.78	0.82±0.027	0.76–0.86	0.81±0.045	0.74–0.87

to the mid points of the sides of the head. Their frontal carinae are straight but diverge posteriorly and the antennal club is 5-jointed.

Myrmica brancuccii Radchenko, Elmes & Collingwood, **sp. n.** (fig 1, *1–5*)

Material. Holotype worker, Nepal, Utrot, 13.05. [19]83, leg. M. Brancucci (NHML). Paratypes: 5 workers, with the same label; 14 workers, Nepal, Lawarai, 21.05. [19]83, leg. M. Brancucci; 1 worker, Nepat, Lumle, 06. [19]88, leg. Collingwood; 9 workers, Pakistan, Chitral V., between Dir and Lavari Pass, 2400 m, 11.08. 1994, leg. S. Dacatra (NHML, NHMB, CAC, RIGATO, SIZK, ELMES).

Workers. Head elongate with convex sides, straight occipital margins and narrowly rounded occipital corners. Anterior clypeal margin prominent and narrowly rounded (not pointed). Eyes relatively small, almost circular. Frontal carinae slightly curved, but not curved outwards and not merging with rugae which surround antennal sockets. 3rd–5th funicular joints about 1.5 times longer than broad. In profile, promesonotal groove distinct and mesonotal dorsum appearing flat or slightly concave; mesonotum curved down abruptly to propodeum to form distinct, wide and deep mesopropodeal furrow. propodeal spines long and relatively very wide at their bases; they project backwards and upwards but slightly curve downwards towards their tips. In profile, petiole high with long anterior peduncle; its anterior surface sharply concave and posterior one nearly straight; dorsal surface of node appears quite short and slightly convex (arched, not flat). In profile, postpetiole appears subrectangular, with feebly convex dorsum, and relatively massive (much larger than petiole); from above, it wide in relation to petiole width. Spurs on middle and hind tibiae short and wide and pectinate only on their distal third.

Dorsal surfaces of head, frons, vertex and clypeus longitudinally rugose but occiput and temples have reticulated sculpture. Surfaces between rugae appear dull, being densely and coarsely punctured; frontal area and clypeus appear more or less shiny having only fine superficial sculpture; mandibles coarsely longitudinally rugose. Dorsum of alitrunk has an irregular sinuous transverse rugosity and reticulation (rugosity of propodeal dorsum may be reduced), and its surface appears dull being coarsely and densely punctured. Sides of alitrunk have similar punctures and sometimes have fine longitudinal striation. Both petiole and postpetiole appear dull, being densely coarsely punctured without rugae or striae. Exceptionally for *Myrmica* species, first gastral ter-

Table 3. The mean, minimum and maximum indices for workers of nine new species of *Myrmica*, calculated from the measurements summarised in table 2. The codes are as indicated in the text and the number of individuals measured are given in parenthesis. In one cases the holotype was the only specimen available

Table 3. Среднее, минимальное и максимальное значение индексов для рабочих 9 видов *Myrmica*, расчитанные по промерам, приводимым в таблице 2. Расшифровку сокращений промеров см. в разделе "Методы"; количество измеренных особей дано в скобках. В одном случае голотип был единственным доступным экземпляром

	M. brancuccii (18)		*M. villosa* (14)		*M. vittata* (4)		*M. williamsi* (1)	*M. nitida* (17)	
	Mean	Min–Max	Mean	Min–Max	Mean	Min–Max	Holotype	Mean	Min–Max
CI	1.23	1.18–1.29	1.17	1.14–1.21	1.22	1.19–1.29	1.29	1.26	1.18–1.31
FI	0.43	0.40–0.45	0.46	0.45–0.48	0.45	0.43–0.49	0.43	0.45	0.41–0.47
FLI	1.06	1.02–1.10	1.03	1.02–1.06	1.07	1.02–1.06	1.09	1.04	1.02–1.06
SI1	0.82	0.78–0.88	0.88	0.87–0.89	0.87	0.86–0.90	0.79	0.77	0.74–0.79
SI2	1.01	0.94–1.10	1.02	1.00–1.06	1.06	1.03–1.15	1.02	0.97	0.91–1.00
PI1	1.25	1.11–1.38	1.24	1.17–1.29	1.43	1.37–1.56	1.25	1.28	1.17–1.38
PI2	0.45	0.41–0.48	0.44	0.42–0.46	0.55	0.51–0.58	0.49	0.46	0.40–0.47
PPI1	0.72	0.62–0.82	0.91	0.88–0.98	0.88	0.86–0.91	0.95	0.91	0.83–0.98
PPI2	1.04	1.00–1.09	1.00	0.97–1.05	0.95	0.94–0.97	0.96	0.98	0.94–1.02
PPI3	1.67	1.41–1.82	1.49	1.43–1.53	1.51	1.48–1.51	1.44	1.46	1.39–1.52
ESLI	0.38	0.34–0.43	0.26	0.23–0.29	0.34	0.33–0.35	0.18	0.19	0.14–0.21
ESDI	1.21	0.95–1.42	1.73	1.61–1.85	1.31	1.21–1.41	2.22	2.13	1.75–2.88
HTI	1.00	0.91–1.04	0.95	0.93–0.99	0.90	0.84–0.94	0.96	0.94	0.88–0.98

Table 3 (cont.)

Таблица 3 (продолжение)

	M. wittmeri (9)		*M. wardi* (18)		*M. ordinaria* (17)		*M. rhytida* (17)	
	Mean	Min–Max	Mean	Min–Max	Mean	Min–Max	Mean	Min–Max
CI	1.28	1.26–1.30	1.27	1.24–1.31	1.24	1.19–1.29	1.24	1.20–1.28
FI	0.44	0.43–0.47	0.44	0.42–0.46	0.44	0.42–0.47	0.42	0.41–0.44
FLI	1.04	0.94–1.08	1.06	1.04–1.10	1.03	1.00–1.06	1.06	1.00–1.08
SI1	0.77	0.75–0.79	0.78	0.75–0.81	0.79	0.74–0.83	0.80	0.76–0.82
SI2	0.99	0.96–1.02	0.99	0.96–1.02	0.98	0.93–1.05	0.99	0.94–1.05
PI1	1.25	1.19–1.30	1.23	1.13–1.33	1.38	1.24–1.52	1.28	1.19-. 33
PI2	0.46	0.44–0.47	0.46	0.42–0.48	0.49	0.44–0.52	0.46	0.43–0.48
PPI1	0.92	0.89–0.96	0.92	0.85–0.98	0.76	0.68–0.90	1.00	0.96–1.06
PPI2	1.01	0.98–1.04	1.02	0.98–1.16	1.04	0.97–1.08	0.97	0.93–1.04
PPI3	1.50	1.45–1.57	1.53	1.41–1.62	1.58	1.54–1.65	1.49	1.37–1.57
ESLI	0.21	0.18–0.24	0.24	0.19–0.33	0.28	0.25–0.32	0.26	0.20–0.31
ESDI	1.76	1.43–1.91	1.66	1.20–2.20	1.39	1.24–1.52	1.57	1.39–1.93
HTI	0.95	0.91–0.98	0.94	0.88–1.02	0.95	0.91–1.00	0.92	0.83–0.97

gite distinctly punctato-striated and appears dull whereas remainder of gaster finely, superficially sculptured and appears shiny. Whole body has numerous straight hairs; those of lateral margins of head abundant and suberect, those of legs abundant and subdecumbent, and those of scape suberect. Colour generally dark reddish-brown but appendages slightly lighter.

Notes. The striato-punctation on the first gastral tergite well discriminates *Myrmica brancuccii* from all other Eurasian *Myrmica* species. This could be a relatively polymorphic species in with comparison of other *Myrmica* species (see measurements in table 2). Its ecology, females and males are unknown.

Myrmica villosa Radchenko & Elmes, sp. n. (fig 1, *6–12*)

Material examined: holotype worker, Dechhi Paka [Bhutan], 5 km O Pelela, 3300 m, 19–20.06.1972 (Natural-History Museum Basel Bhutan Expedition, 1972) (NHMB). Paratypes: 15 workers, 1 female (dealate), with the same label (NHML, NHMB, SIZK, ELMES)

Workers. Head elongate and on most specimens slightly narrowed anteriorly (although on some specimens sides parallel); occipital margins slightly concave or straight (not convex) with rounded occipital corners. Anterior clypeal margin narrowly rounded (not pointed) and more or less prominent. Frontal carinae short and more or less straight; they do not curved outwards and do not merging with rugae surrounding antennal sockets. In profile, pronotum feebly convex, mesonotum flattened or even slightly concave, and mesonotum curved down abruptly to propodeum to form distinct, wide and deep mesopropodeal furrow. Propodeal spines relatively short, sharply pointed, straight or slightly curved down, not broad at their bases and projecting back-

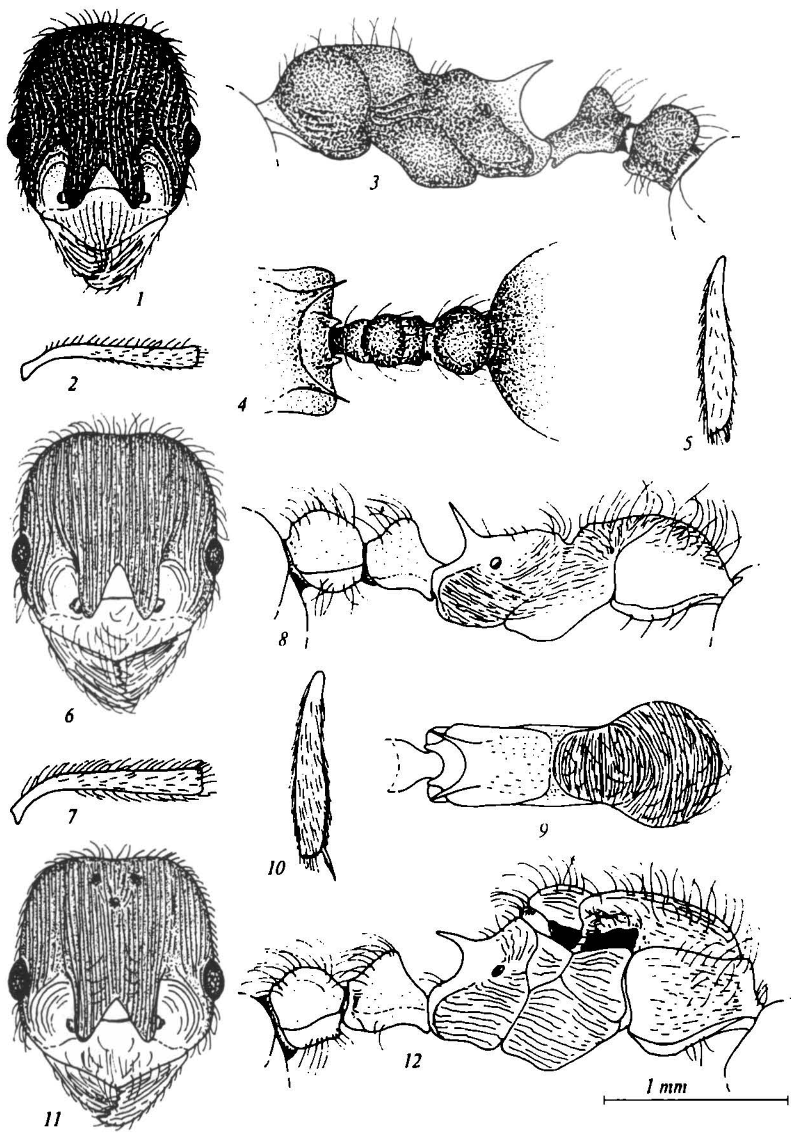


Fig. 1. Details of structure of *Myrmica brancuccii* (*1–5* — worker, holotype) and *M. villosa* (*6–10* — worker, holotype, *11–12* — female, paratype): *1, 6, 11* — head, frontal view; *2, 7* — antennal scape; *3, 8, 12* — alitrunk and waist in profile; *4* — propodeal spines, waist and base of first gastral tergite from above; *5, 10* — hind tibia; *9* — alitrunk from above.

Рис. 1. Детали строения *Myrmica brancuccii* (*1–5* — рабочий, голотип) и *M. villosa* (*6–10* — рабочий, голотип, *11–12* — самка, паратип): *1, 6, 11* — голова спереди; *2, 7* — скапус антенн; *3, 8, 12* — грудь и стебелек в профиль; *4* — шипы проподеума, стебелек и основание первого тергита брюшка сверху; *5, 10* — задняя голень; *9* — грудь сверху.

wards and upwards. Petiole relatively short and high with short anterior peduncle; in profile, its anterior surface appearing concave and posterior one somewhat convex; dorsum of petiolar node broadly rounded. Postpetiole more or less spherical and with its apex in profile posterior to mid-point.

Head dorsum extremely densely but finely longitudinally rugulose, surfaces between rugae punctured and appear dull. Mandibles with dense, fine, longitudinal rugulae; clypeus very finely rugulose or even striated, superficially punctured and appears more or less shiny; frontal area smooth and shiny. Alitrunk dorsum has dense, fine, transverse rugulae with sculpture on propodeum often reduced to superficial striation and propodeal declivity smooth and shiny; alitrunk sides finely striato-rugulose. Entire body (except propodeum) with abundant long, fine, curved, whitish hairs; those on legs and lateral margins of head being short and subdecumbent while those on antennal scape short and suberect. General colour brownish-red but head dorsum darker reddish-brown and gaster reddish-brown to dark brown

Female (dealate). As worker except head subrectangular with parallel sides and has very feebly concave occipital margin; alitrunk relatively high and wide; propodeal spines relatively shorter and slightly more curved downwards; petiole in profile, has relatively longer anterior peduncle, its node more triangular but narrowly rounded at its apex, and its posterior surface appears straighter. Sculpture and pilosity generally similar to worker except clypeus appears even less striated. Scutum longitudinally rugulose, scutellum has arched rugae, pronotum striated with meso- and metapleura being longitudinally rugulose. Its colour generally reddish-brown with head dorsum dark brown.

Notes. Males are unknown. *M. villosa* is closely related to *M. pachei* Forel but differs from it mainly by a denser sculpture of the head dorsum, by its more abundant, long, thin, fine, curved body hairs and longer hairs on legs (*M. pachei* has distinctly shorter, thicker and straighter hairs), and by lighter coloured alitrunk. Females also differ by non-striated petiolar and post-petiolar nodes and by a less strongly sculptured alitrunk. Its ecology is unknown.

Myrmica vittata Radchenko & Elmes, **sp. n.** (fig 2, *1–4*)

Material. Holotype worker, Pakistan, Bumburet, 24.05. [19]83, leg. M. Brancucci (NHML). Paratypes: 2 workers, with the same label; 2 workers, Pakistan, Kalam, 12.08.1994, leg. S. Dakatra (NHML, RIGATO, SIZK, ELMES).

Workers. Head elongate with slightly convex sides and occipital margin, and broadly rounded occipital corners. Anterior clypeal margin pointed. Frontal carinae slightly curved outwards. Antennal sockets not surrounded by rugae. Antennal scapes relatively thick and long. Alitrunk dorsum very weakly convex in profile, and mesopropodeal furrow very shallow. Propodeal spines projected backwards and comparatively long, straight and massive with very broad bases. In profile, petiole high with very long, slender anterior peduncle; its node more or less square (slightly trapezoid), dorsal surface slightly convex and curves into posterior surface. postpetiole relatively wide, higher than long, and antero-dorsal surfaces appearing arched in profile.

Entire head dorsum (including clypeus) coarsely longitudinally rugose without reticulate sculpture; frontal area and surfaces between rugae smooth and shiny; mandibles densely longitudinally rugoso-striated. Alitrunk dorsum and sides with coarse, longitudinal rugae (no punctures or reticulation); propodeal declivity between spines smooth and shiny. Both petiolar nodes with concentric rugae with only central area of postpetiole node being smooth (viewed from above), and longitudinal rugae when viewed from side. Wole body appearing shiny and with abundant long, thin, erect to suberect hairs (including lateral margins of head), those of legs and scapes mostly suberect. Head, alitrunk and waist reddish-brown, gaster brown and legs and antennae, testaceous red.

Notes. Females and males are unknown. The ecology is not known. *M. vittata* can be discriminated from all other Eurasian *Myrmica* species which have antennal scapes that are weakly curved at their bases, by the absence of rugae surrounded the antennal sockets and the coarse, regular longitudinal rugosity of the head, alitrunk (including dorsum) and petiolar nodes.

Myrmica williamsi Radchenko & Elmes, **sp. n.** (fig 2, *5–8*)

Material. Holotype worker, India, Kashmir, Pantitop, 2000 m, 6.09.[19]86, leg. P. Williams (NHML).

Worker. Head relatively long with parallel sides, straight occipital margins and narrowly rounded occipital corners. Anterior clypeal margin prominent and narrowly rounded (not pointed). Frontal carinae short and slightly curved outwards to merge with rugae which surround antennal sockets. In profile, promesonotum very feebly convex and mesonotum curves down abruptly to propodeum to form distinct wide and deep mesopropodeal furrow. Propodeal spines short, dentiform but sharp. Petiole with relatively short and thick anterior peduncle; in profile appearing subtriangular with its anterior surface slightly concave and posterodorsal surface broadly rounded. Postpetiole subglobular but not large relative to petiole.

Central part of head dorsum with longitudinal, more or less straight rugae and temples with sinuous rugae, surfaces between rugae coarsely and densely punctured.

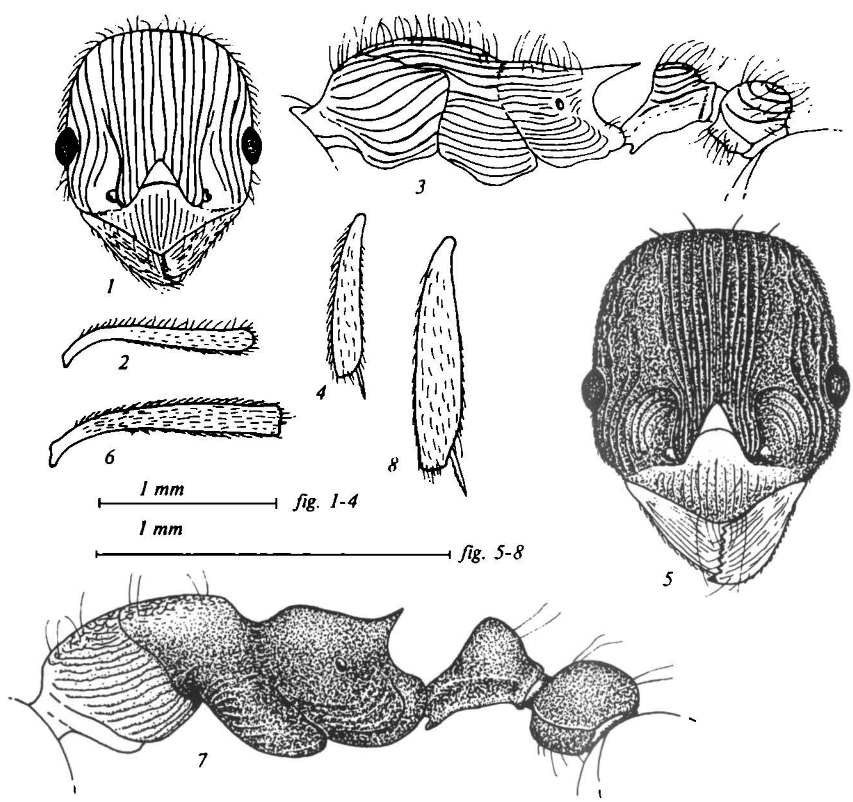


Fig. 2. Details of structure of *Myrmica vittata* (*1–4* — worker, holotype) and *M. williamsi* (*5–8* — worker, holotype): *1, 5* — head, frontal view; *2, 6* — antennal scape; *3, 7*- alitrunk and waist in profile; 4, *8* — hind tibia.

Рис. 2. Детали строения *Myrmica vittata* (*1–4* — рабочий, голотип) и *M. williamsi* (*5–8* — рабочий, голотип): *1, 5* — голова спереди; *2, 6* — скапус антенн; *3, 7* — грудь и стебелек в профиль; *4, 8* — задняя голень.

Clypeus longitudinally rugose with finely punctured surface; frontal smooth and shiny; mandibles densely striated. Promesonotal dorsum coarsely reticulate and very finely punctured; sides of pronotum sinuously rugulose; remainder of alitrunk, petiole and postpetiole with no rugae but densely punctured. Body generally with sparse, straight, thick erect hairs; those of lateral margins of head very short and decumbent; legs and scapes with abundant, decumbent hairs. Whole body appearing brownish-black; appendages dark brown.

Notes. Females and males are unknown. The ecology is not known. *M. williamsi* differs from all *Myrmica* species that have antennal scapes weakly curved at their bases and frontal carinae slightly curved outwards to merge with the rugae which surround their antennal sockets, by a combination of very short propodeal spines and an unusual sculpture of alitrunk.

Myrmica nitida Radchenko & Elmes, **sp. n.** (fig 3, *1–10*)

Material. Holotype worker, Kashmir [India], 1 km NE Yehmer Pass, 34°13' N, 75°10' E, 3600 m, 06.08.1978, leg. P. Ward, acc. No 3044; alpine vegetation, under stone (NHML). Paratypes: 9 workers, from the same nest as holotype; 17 workers, 4 females (alate), 2 males, Kashmir, Sanang, 2600–2750 m, leg. W. Wittmer (NHML, NHMB, WARD, SIZK, ELMES).

Workers. Head long with parallel or slightly convex sides, straight occipital margins and rounded occipital corners. Anterior clypeal margin pointed. Frontal carinae short, almost straight and do not curve outwards to merge with rugae which surround antennal sockets. 3rd–5th funicular joints particularly short, only slightly longer than broad. In profile, promesonotum very feebly convex and mesonotum curved down abruptly to propodeum to form distinct, wide and deep mesopropodeal furrow. Propodeal spines extremely short (dentiform in some specimens) and project upwards (but < 45?); they have sharp points and relatively wide bases. Petiole in profile, low with long anterior peduncle; distinctly concave anterior surface meets convex posterodorsal surface to form 90? (or even more acute) anterior edge to petiolar node which nevertheless distinct.

Head dorsum longitudinally rugulose and surfaces between rugae appearing shiny although they finely, superficially punctured. Mandibles finely longitudinally rugulose; clypeus very finely striated but appearing shiny; frontal area smooth and shiny. Surface of alitrunk appearing smooth with superficial punctures on dorsum and short fine striations on sides. Petiole, postpetiole and gaster appearing smooth and shiny. Entire body with straight coarse golden hairs, those of legs and antennal scape decumbent, and those of lateral margins of head short and decumbent. Colour of alitrunk, peduncle, scapes and legs yellowish-red and head dorsum and gaster brownish-red.

Females. Generally like the workers except: Head subrectangular (more square than that of worker), with parallel sides, straight occipital margins and broadly rounded occipital corners; anterior clypeal margin convex (not distinctly pointed); frontal carinae very gently curved outwards and merging into rugae which surround antennal sockets; antennal scapes relatively shorter than those of workers. Alitrunk high and relatively narrow and propodeal spines very short, dentiform, blunt and relatively very broad at their bases. General shape of petiole similar to that of workers, but dorsal surface more broadly rounded. In profile, postpetiole appearing more rectangular than that of workers, with antero-dorsal surface forming an arch with an apex posterior to mid point. Sculpture of head resembles that of workers except for clypeus which more coarsely rugulose. Scutum with longitudinal rugae, scutellum with arched rugae and sides of alitrunk with dense, fine longitudinal striation. Pilosity generally like worker except hairs of body less erect and slightly curved, and those of antennal scape more decumbent. Body colour generally yellowish-red, with reddish-yellow appendages and patches of brownish-red on head dorsum, scutum and scutellum.

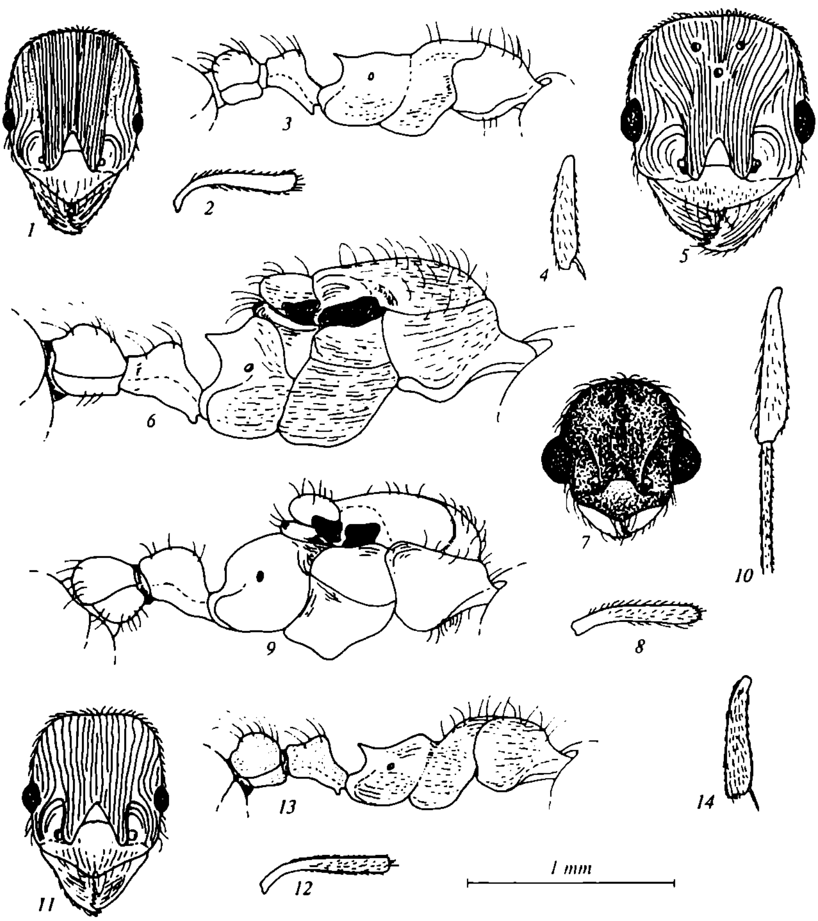


Fig. 3. Details of structure of *Myrmica nitida* (*1–4* — worker, holotype, *5, 6* — female, paratype, *7–10* — male, paratype) and *M. wittmeri* (*11–14* — worker, holotype): *1, 5, 7, 11* — head, frontal view; *2, 8, 12* — antennal scape; *3, 6, 9, 13* — alitrunk and waist in profile; *4, 10, 14* — hind tibia.

Рис. 3. Детали строения *Myrmica nitida* (*1–4* — рабочий, голотип, *5, 6* — самка, паратип, *7–10* — самец, паратип) и *M. wittmeri* (*11–14* — рабочий, голотип): *1, 5, 7, 11* — голова спереди; *2, 8, 12* — скапус антенн; *3, 6, 9, 13* — грудь и стебелек в профиль; *4, 10, 14* — задняя голень.

Males. Head slightly longer than broad with convex sides, slightly convex occipital and anterior clypeal margins, rounded occipital corners and relatively small ocelli. Eyes relatively small and situated distinctly anterior to mid point of head sides. Antennal scape long, thin and weakly curved at base. Masticatory margins of mandibles distinct, with 6 teeth (long apical tooth and 5 small sharp ones). Alitrunk relatively high and wide with slightly arched scutum; propodeal dorsum relatively long and arched with only short, slightly concave declivity, and no teeth (although it appearing more or less sharply angulate); metapleural lobes sharply rounded. Petiole in profile, appearing ovoid (being longer than high) but with short, distinct anterior peduncle; postpetiole ovoid (higher than long).

Entire head dorsum, including frontal areand clypeus, densely punctured and appearing dull. Frons with relatively deep longitudinal depression and finely striated. Alitrunk, peduncle and gaster smooth and shiny, with only lower parts of mesopleura having short superficial striation. Hairs on occipital and lateral margins of head, mandibles, alitrunk, petiole, postpetiole and gaster long and suberect; those on legs sparse and decumbent; those on antennal scape short, stout and suberect. General colour dark-yellowish red.

Table 4. The mean, minimum and maximum values (mm) of the measurements made on samples of queens and males from six new species of *Myrmica* from the Himalaya. The measurements codes are as indicated in the methods and the number of individuals measured are given in parenthesis

Таблица 4. Среднее, минимальное и максимальное значения (мм) промеров, выполненных на выборках цариц и самцов 6 новых видов *Myrmica* из Гималаев. Расшифровку сокращений промеров см. в разделе "Методы"; количество измеренных особей дано в скобках

	♀ *M. villosa*	♀ *M. nitida* (3)		♀ *M. wardi* (2)		♀ *M. ordinaria*	♀ *M. rhytida* (16)	
		Mean	Min–Max	Mean	Min–Max		Mean	Min–Max
HW	1.09	0.98	0.97–0.99	0.95	0.88–1.02	0.90	0.98	0.92–1.02
HL	1.26	1.17	1.15–1.19	1.14	1.09–1.19	1.14	1.17	1.12–1.22
FW	0.50	0.44	0.43–0.45	0.39	0.38–0.41	0.42	0.41	0.39–0.43
FLW	0.53	0.46	0.45–0.46	0.41	0.39–0.42	0.43	0.43	0.41–0.46
SL	1.09	0.88	0.85–0.90	0.88	0.80–0.95	0.84	0.88	0.80–0.92
PW	0.32	0.30	0.29–0.31	0.27	0.25–0.29	0.26	0.30	0.28–0.32
PPW	0.48	0.45	0.45–0.46	0.45	0.41–0.49	0.44	0.46	0.42–0.49
PH	0.41	0.40	0.39–0.41	0.36	0.34–0.38	0.35	0.39	0.35–0.42
PPH	0.45	0.46	0.46–0.46	0.42	0.39–0.45	0.46	0.44	0.41–0.48
PL	0.52	0.49	0.48–0.49	0.49	0.42–0.56	0.54	0.55	0.50–0.58
PPL	0.41	0.38	0.36–0.39	0.41	0.38–0.45	0.35	0.40	0.36–0.45
ESL	0.32	0.19	0.18–0.20	0.22	0.18–0.25	0.24	0.20	0.17–0.24
ESD	0.56	0.45	0.43–0.46	0.44	0.36–0.53	0.40	0.42	0.38–0.47
AL	1.89	1.83	1.81–1.85	1.80	1.64–1.96	1.88	1.83	1.70–1.96
HTL	1.02	0.94	0.92–0.95	0.91	0.84–0.98	0.88	0.88	0.78–0.98
SCW	0.81	0.89	0.85–0.91	0.88	0.81–0.95	0.88	0.85	0.78–0.92
SCL	1.25	1.28	1.26–1.30	1.32	1.22–1.43	1.34	1.25	1.16–1.34
AH	0.99	1.09	1.05–1.13	1.09	0.98–1.20	1.08	1.08	1.02–1.15
WL							6.60	6.40–6.85
WB							2.03	2.00–2.08

Table 4 (cont.)

Таблица 4 (продолжение)

	♀ *M. petita*	♂ *M. nitida*	♂ M. *wardi* (2)		♂ *M. rhytida* (12)	
			Mean	Min–Max	Mean	Min–Max
HW	0.82	0.74	0.68	0.64–0.72	0.74	0.67–0.80
HL	1.02	0.83	0.74	0.71–0.76	0.85	0.76–0.90
FW	0.34					
FLW	0.37					
SL	0.74	0.73	0.39	0.35–0.42	0.77	0.70–0.84
PW	0.24	0.31	0.28	0.27–0.29	0.28	0.24–0.31
PPW	0.38	0.42	0.39	0.38–0.41	0.42	0.38–0.45
PH	0.34	0.34	0.32	0.31–0.34	0.33	0.29–0.35
PPH	0.38	0.43	0.40	0.38–0.42	0.40	0.37–0.43
PL	0.46	0.42	0.43	0.42–0.45	0.46	0.39–0.48
PPL	0.32	0.43	0.34	0.32–0.36	0.36	0.32–0.38
ESL	0.24					
ESD	0.40					
AL	1.58	1.61	1.60	1.50–1.69	1.69	1.53–1.79
HTL	0.74	0.97	0.99	0.94–1.04	0.97	0.84–1.05
SCW	0.74	0.84	0.97	0.94–0.99	0.89	0.80–0.99
SCL	1.16	1.12	1.18	1.13–1.22	1.17	1.04–1.25
AH	0.94	1.08	0.97	0.92–1.01	1.04	0.87–1.13
WL			5.12	4.80–5.44	5.10	4.56–5.50
WB			1.64	1.60–1.68	1.66	1.52–1.85

Notes. *M. nitida* is probably related to the *M. cashmiriensis* complex, but its workers well differ from all other Eurasian *Myrmica* species by the combination of an almost entirely smooth alitrunk and very short, dentiform propodeal spines. The females differ from the *M. cashmiriensis* complex by having a much less strongly sculptured alitrunk and especially waist.

The males differ from all Himlayan species, which males have long antennal scape, by smooth and shiny alitrunk and waist. Little is known about its ecology other than one colony was found living in the same habitat in Kashmir as *M. rhytida*, at 3600m, under a stone, on small ridge on the west side of a lake, with scattered juniper and rhododendron shrubs and a ground cover of various herbs and flowers (P. Ward, *pers. comm.)*.

Myrmica wittmeri Radchenko & Elmes, **sp. n.** (fig 3, *11–14*)

Material. Holotype worker, Indien, Him. [mahal] Prad. [esh], Mahri, 3000–3200 m, 15.05.1977, leg. Wittmer et Brancucci (NHMB). Paratypes: 3 workers (one without head), with the same label; 3 workers, Pakistan, Kalam, 2300 m, 12.07. [19]94, leg. S. Dakatra; 6 workers, India, Himahal Pradesh, Kullu valley, La Pass, 3400–3700 m, 02.10.1996, No. 420, 422, leg. A. Schulz & K. Vock (NHMB, RIGATO, SCHULZ, SIZK, ELMES).

Workers. Head long with feebly convex sides, straight occipital margin and rounded occipital corners. Anterior clypeal margin narrowly rounded and prominent (not pointed). Frontal carinae short, almost straight, curving slightly outwards to merge with rugae which surround antennal sockets. 3rd–5th funicular joints about 1.5 times longer than wide. In profile, promesonotum appearing convex and promesonotal groove distinct and mesonotum curved down abruptly to propodeum to form distinct, wide and deep mesopropodeal furrow. Propodeal spines short but sharp, with relatively broad bases. Petiole with relatively short anterior peduncle; in profile, its anterior surface concave and node appearing subtriangular with narrowly rounded dorsum. Postpetiole appearing subcubical with gradually and feebly arched anterodorsal surface.

Head dorsum longitudinally rugose and surfaces between rugae smooth and shiny; clypeus longitudinally rugose (although in some specimens central part with reduced sculpture and appearing smooth); frontal area Smooth and shiny; mandibles densely longitudinally striated. Dorsum of promesonotum with reticulate sculpture combined with irregular transversal rugosity; lateral parts of alitrunk and propodeal dorsum with reduced irregular longitudinal rugulosity or striation, with surfaces between rugae appearing smooth and shiny. Petiolar and postpetiolar nodes finely punctured but appearing more or less shiny; central area of postpetiolar dorsum smooth. Body with straight, erect to suberect hairs; those of lateral margins of head, and appendages very short and decumbent. Entire body brownish-red.

Notes. Females and males are unknown. The ecology is not known. *M. wittmeri* closely resembles *M. nitida* sp. n., but clearly differs from it by its distinctly coarser sculpture of the alitrunk, its darker colour and its narrowly rounded petiolar node.

Myrmica wardi Radchenko & Elmes, **sp. n.** (fig 4, *1–10*)

Material. Holotype worker, [India], Kashmir, Ladakh, Leh, 34°11' N, 77°35' E, 3450 m, No. 3094, 21.08.1978, leg P. Ward (NHML). Paratypes: 6 workers with the same label; 6 workers, 1 female, [India], Kashmir, Pahalgam, 34°02' N, 75°19' E, 2190 m, No. 3003, 27.07.1978; about 100 workers, 2 males, [India], Kashmir, Lidderwat, 34°09' N, 75°15' E, 2700 m, No. 3015, 3018c, 3023, 3029, 30.07.1978; 1 worker, 1 female, [India], Kashmir, Kulan, 34°16' N, 75°09' E, 2100 m, No. 3050–10, 3050–12, 08.08.1978; 29 workers, 1 female, [India], Kashmir, Ladakh, Panikhar, Suru R., 34°07' N, 75°57' E, No. 3077, 3078, 17.08.1978; 3 workers, [India], Kashmir, Ladakh, Leh, 34°11' N, 77°35' E, 3450 m, No. 3090, 21.08.1978; 4 workers, [India], Kashmir, Sonamarg, 34°18' N, 75°18' E, 2700 m, No. 3102 (all leg. P. Ward); 8 workers, Pakistan, Chitral Valley, between Dir and Lawari Pass, 2400 m, 11.08.1994, leg. S. Dacatra; 3 workers, Indien, Himahal Pradesh, vic. Theong, 25 km E Shimla, 2400m, No 394, 29.09.1996, leg. A. Schulz & K. Vock; 3 workers, 2 females, India, Himahal Pradesh, Kullu valley, 5–7 km SW Rothang La Pass, 2500–2900 m, No. 432, 01.10.1996, leg. A. Schulz & K. Vock (NHML, NHMB, RIGATO, SCHULZ, WARD,

00 m, No. 432, 01.10.1996, leg. A. Schulz & K. Vock (NHML, NHMB, RIGATO, SCHULZ, WARD, SIZK, ELMES, MEI).

Workers. Head long, with parallel sides, straight or very feebly convex occipital margins, and narrowly rounded occipital corners. Anterior clypeal margin prominent and pointed. Frontal carinae short, almost straight but curved outwards to merge with rugae which surround antennal sockets; although antennal scape appearing slender and long, it distinctly shorter than head. In profile, pronotum appearing feebly convex and mesonotal dorsum concave and mesonotum curves down abruptly to propodeum to form distinct, wide and deep mesopropodeal furrow. Propodeal spines relatively short, thin, straight (sometimes slightly curved downwards), relatively broad at their bases,

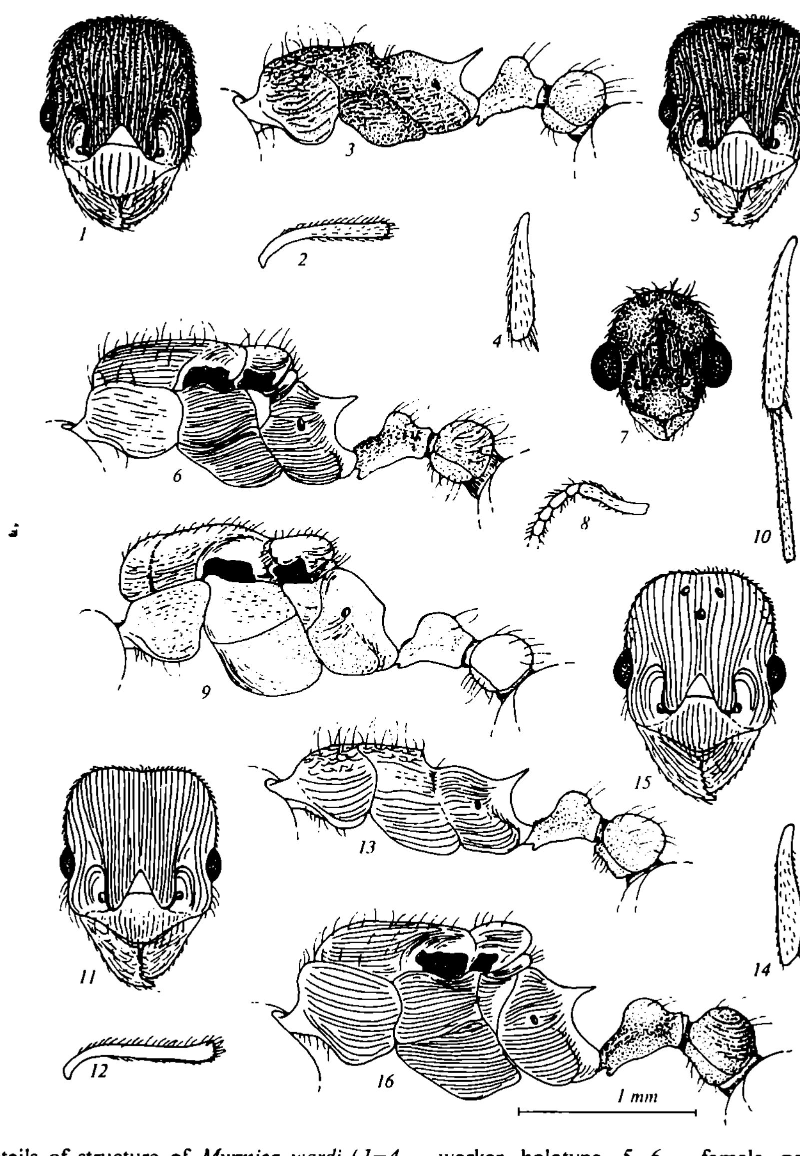


Fig. 4. Details of structure of *Myrmica wardi* (*1–4* — worker, holotype, *5, 6* — female, paratype, *7–10* — male, paratype) and *M. ordinaria* (*11–14* — worker, holotype): *1, 5, 7, 11* — head, frontal view; *2, 8, 12* — antennal scape; *3, 6, 9, 13* — alitrunk and waist in profile; *4, 10, 14* — hind tibia.

Рис. 4. Детали строения *Myrmica wardi* (*1–4* — рабочий, голотип, *5, 6* — самка, паратип, *7–10* — самец, паратип) и *M. ordinaria* (*11–14* — рабочий, голотип): *1, 5, 7, 11*— голова спереди; *2, 8, 12* — скапус антенн; *3, 6, 9, 13* — грудь и стебелек в профиль; *4, 10, 14* — задняя голень.

and projecting backwards and upwards (angle < 45°). Petiole with long thick anterior peduncle and in profile, relatively high, with relatively long node broadly rounded. Postpetiole subcubical with slightly arched antero-dorsal surface.

Head dorsum longitudinally rugulose and surfaces between rugae densely and coarsely punctured, and appearing submatte to dull; clypeus longitudinally rugose; frontal areaand clypeus appearing shiny; mandibles with fine longitudinal rugulosity. Promesonotal dorsum irregularly rugoso-reticulate; propodeal dorsum with fine reduced longitudinal rugulose sculpture; pro- and mesopleura longitudinally rugoso-striated. Surfaces between rugae finely but distinctly punctured; sides of propodeum coarsely punctured and (in some specimens) lower parts longitudinally rugulose. Petiole and postpetiole densely but finely punctured, and appearing submatte. Body with relatively few long, thin, erect to suberect hairs; lateral margins of head, and appendages with short, decumbent pilosity. General colour dark brown to black, legs and antennae dark reddish-brown.

Females. Generally similar to workers in shape of head, sculpture, colouration and pilosity except: antennal scape relatively shorter; frontal carinae weakly curved but not curved outwards to merge with rugae which surround antennal sockets; alitrunk relatively long and wide; propodeal spines relatively shorter than those of workers. Scutum densely, longitudinally rugulose, central part of scutellum smooth and shiny, remainder with short, longitudinal rugae; sides of alitrunk regularly longitudinally rugulose, and surfaces not punctured and appearing shiny. Both petiole and postpetiole more densely punctured and appearing submatte; postpetiole also with longitudinally concentric striation.

Males. Head slightly longer than broad, with convex sides, slightly convex occipital margins and broadly rounded occipital corners. Anterior clypeal margins slightly prominent and pointed medially. Antennal scapes short (shorter than sum of length of funicular joints 1–4) and very feebly curved at their bases. Masticatory margin of mandibles distinct, with 5 small acute teeth and longer apical tooth. Alitrunk relatively long and wide; in profile scutum appearing slightly convex; propodeum with short blunt denticles; metapleural lobes rounded. Petiole with short, thick but distinct anterior peduncle; it distinctly longer than high; its anterior surface appearing slightly concave in profile, and its posterior one convex; node appearing relatively long with broadly rounded dorsum. Postpetiole appearing subglobular.

Entire head dorsum (including frontal area and clypeus) densely punctured and appearing dull; frons also with quite deep longitudinal grooves and striations. Scutellum and central part of distal half of scutum finely longitudinally rugulose; sides of alitrunk finely punctato-striated (sculpture may be reduced in some places). Petiolar node very finely punctured but postpetiole and gaster smooth and shiny. Occipital margins of head with relatively long suberect hairs; temples and cheeks with short subdecumbent pilosity; alitrunk, petiole, postpetiole and gaster with relatively sparse, more or less short, straight, suberect hairs; legs and scapes with short, subdecumbent hairs. General colour dark reddish-brown but head dark brown.

Notes. *M. wardi* is similar to *Myrmica cachmiriensis* Forel; its workers differ by their darker colour and distinctly shorter propodeal spines (ESLI = 0.19–0.33 *v* 0.51–0.68), and females differ by their darker colour and longer head (CI = 1.16–1.24 *v* 1.12–1.20). Males differ by their distinctly higher petiole (PI1 = 1.33–1.36 *v* 1.40–1.64) and by the reduced rugulosity and presence of punctures on the sides of the alitrunk (those of *M. cachmiriensis* are densely but not coarsely rugulose). A little is known about its ecology (P. Ward, *pers. comm.*). Ants were collected in Kashmir at altitudes of 2190–3450 m in the same regions, but at lower altitudes than *M. rhytida* (mean 2700 m *v* 3600 m). *M. wardi* was distinctly more associated with open woodland than *M. rhytida,* particularly from meadows with sparse trees — willow, prunus, acer and fir species, also from among woody shrubs with *Rosa* sp. and stony grasslands and pastures having a low sward. The few nests that were found were built in the soil and

having a low sward. The few nests that were found were built in the soil and most specimens were collected while foraging, which supports the idea that this species does not often use stones as nest sites. Foragers freely climbed over low vegetation, perhaps being indicative of habit similar to the European *Myrmica rubra* L.

Myrmica ordinaria Radchenko & Elmes, **sp. n.** (fig 4, *11–16*)

Material. Holotype worker, India, Kashmir, Seven Springs. 29.07. [19]86, leg. P. Williams (NHML). Paratypes: 23 workers, 1 female (dealate), with the same label; 6 workers, Pakistan, Kalam, 2300 m, 12.07. [19]94, leg. S. Dakatra (NHML, NHMB, RIGATO, SIZK, ELMES).

Workers. Head long, with parallel sides, straight or very feebly concave occipital margin, and narrowly rounded occipital corners. Anterior clypeal margin narrowly rounded and prominent (not pointed). Frontal carinae short, almost straight but curving outwards to merge with rugae which surround antennal sockets; although antennal scapes appearing relatively long and slender, they distinctly shorter than head; 3rd–5th funicular joints about 1.5 times longer than broad. In profile, promesonotum flattened and in some specimens, mesonotal dorsum slightly concave and mesonotum curves down abruptly to propodeum to form distinct wide and deep, mesopropodeal furrow. Propodeal spines relatively long, thin, straight and slightly broadened at their bases, they project backwards and upwards at $< 45°$ to horizontal. Petiole with long, thick anterior peduncle and relatively high; petiolar node appearing relatively large and long in profile, and its dorsal surface gently rounded. Postpetiole subcubical, with slightly arched antero-dorsal surfaces.

Entire head dorsum (including clypeus) longitudinally rugulose; central frons with more than 15 rugae; surface between rugae finely superficially punctured but appearing shiny; frontal aresmooth and shiny; mandibles densely, longitudinally rugoso-striated. Whole alitrunk appearing shiny; promesonotal dorsum irregularly rugoso-reticulate; propodeal dorsum with fine reduced longitudinal rugulosity; sides of alitrunk finely longitudinally rugoso-striated. Petiole and postpetiole densely but finely punctured, and appearing submatte. Body with relatively sparse long, thin, erect to suberect hairs; those of lateral margins of head short and decumbent; those of appendages subdecumbent. Entire body coloured dark brown to black, and legs and antennae dark reddish-brown.

Female. Generally like workers in shape of head, sculpture, coloration and pilosity except: antennal scape relatively shorter; alitrunk relatively long and wide; propodeal spine distinctly shorter and projected backwards more horizontally; pattern of sculpture on head dorsum same but slightly coarser; besides being punctured, postpetiole also with some longitudinally concentric striation. Scutum densely longitudinally rugulose and scutellum with partly reduced rugulosity.

Notes. Males are unknown. The ecology is not known. *M. ordinaria* is closely related to *M. wardi* and *M. cachmiriensis* Forel. Workers and females of *M. ordinaria* differ from *M. wardi* by the very finely punctured, more or less smooth surfaces between the rugae of their head and alitrunk; workers also differ by a flat (not concave) mesonotal dorsum. Workers and females differ from *M. cachmiriensis* by their much darker colour of the body (*M. cachmiriensis* is testaceous red); females also differ by having longer heads (CI = 1.27 *v* 1.12–1.20).

Myrmica rhytida Radchenko & Elmes, **sp. n.** (fig 5, *1–10*)

Material. Holotype worker, [India], Kashmir, Up. Kainthal Nar, 34°00' N, 70 45' E, 3750 m, No. 3061, 14.08.1978, leg. P. Ward (NHML). Paratypes: 113 workers and 32 males, from the same nest; 3 females, 4 males, [India], Kashmir, 3 km NE Tar Sar, 34°09' N, 75°11' E, 3300 m, No. 3037, 02.08.1978; about 200 workers, 10 females (dealate), 5 males, [India], Kashmir, Tar Sar, 34°09' N, 75°09' E, 3950 m, No. 3038, 3039, 3040, 3041, 3042, 04.08.1978; 25 workers, [India], Kashmir, 1 km NE Yehmer Pass, 34°13' N, 75°10' E, 3600 m, No. 3043, 3045, 06.08.1978; 84 workers, 7 female (dealate), 4 males, [India],

Kashmir, 4 km S Kulan, 34°14' N, 75°10' E, 3599 m, No. 3046, 3048, 07.08.1978; 3 workers, [India], Kashmir, Sain Nar, 34°06' N, 75°34' E, 3750 m, No. 3054, 11.08.1978; 4 workers, 1 female, 4 males, [India], Kashmir, Wampet, 34°04' N, 75°37' E, 3700 m, No. 3057, 12.08.1978; 1 male, [India], Kashmir, Up. Kaintal Nar, Oitto, 34°00' N, 75°45' E, 4200 m, No. 3068 (all leg. P. Ward); 3 workers, India, Beastel, 20 km S Rhotang, 2800 m, No. J-23, 18.08.1990, leg. J. Heinze (NHML, NHMB, RIGATO, SCHULZ, WARD, SIZK, ELMES, MEI).

Workers. Head long with parallel sides, straight or very feebly convex occipital margins, and narrowly rounded occipital corners. Anterior clypeal margin prominent

Table 5. The mean, minimum and maximum indices of males and queens of six new *Myrmica* species. The measurements codes are as indicated in the methods and the number of individuals measured are given in parenthesis

Табл. 5. Среднее, минимальное и максимальное значение индексов для самок и самцов 6 видов *Myrmica*, подсчитанные как указано в тексте; количество измерянных экземпляров приведено в скобках

	♀ *M villosa*	♀ *M. nitida* (3)		♀ *M. wardi* (2)		♀ *M. ordinaria*	♀ *M. rhytida* (16)	
		Mean	Min–Max	Mean	Min–Max		Mean	Min–Max
CI	1.15	1.20	1.19–1.20	1.20	1.16–1.24	1.27	1.20	1.17–1.24
FI	0.46	0.45	0.44–0.46	0.41	0.40–0.43	0.47	0.42	0.41–0.43
FLI	1.06	1.03	1.03	1.035	1.03–1.04	1.07	1.05	1.02–1.07
SI1	0.87	0.75	0.74–0.76	0.76	0.73–0.80	0.74	0.75	0.71–0.80
SI2	1.00	0.90	0.88–0.91	0.92	0.90–0.93	0.93	0.90	0.86–0.96
PI1	1.28	1.22	1.19–1.25	1.37	1.25–1.48	1.54	1.43	1.27–1.56
PI2	0.47	0.50	0.49–0.50	0.51	0.48–0.55	0.60	0.57	0.51–0.61
PPI1	0.91	0.83	0.80–0.85	0.98	0.96–1.00	0.76	0.90	0.83–0.96
PPI2	0.94	1.01	1.00–1.02	0.94	0.91–0.97	1.05	0.97	0.91–1.00
PPI3	1.48	1.52	1.50–1.52	1.64	1.61–1.67	1.69	1.55	1.48–1.64
ESLI	0.29	0.20	0.18–0.20	0.23	0.21–0.25	0.27	0.20	0.17–0.25
ESDI	1.74	2.33	2.21–2.54	2.04	1.96–2.11	1.67	2.13	1.88–2.50
HTI	0.94	0.96	0.96–0.96	0.96	0.95–0.96	0.98	0.90	0.83–0.97
AI	1.90	1.68	1.63–1.72	1.65	1.63–1.67	1.74	1.69	1.62–1.75
SCI	1.53	1.45	1.43–1.48	1.50	1.50–1.50	1.52	1.47	1.28–1.59
WI1							6.62	6.43–6.79

Table 5 (cont.)

Таблица 5 (продолжение)

	♀ *M. petita*	♂ *M. nitida*	♂ *M. wardi* (2)		♂ *M. rhytida* (12)	
			Mean	Min–Max	Mean	Min–Max
CI	1.24	1.11	1.08	1.05–1.11	1.14	1.11–1.16
FI	0.41					
FLI	1.09					
SI1	0.73	0.88	0.52	0.49–0.56	0.90	0.85–0.95
SI2	0.90	0.98	0.56	0.54–0.58	1.03	0.98–1.09
PI1	1.35	1.25	1.34	1.33–1.36	1.41	1.14–1.59
PI2	0.56	0.57	0.64	0.62–0.65	0.62	0.56–0.69
PPI1	0.84	1.00	0.86	0.85–0.87	0.89	0.82–0.98
PPI2	1.00	1.03	1.02	1.00–1.03	0.97	0.88–1.04
PPI3	1.58	1.36	1.40	1.38–1.42	1.48	1.23–1.58
ESLI	0.29					
ESDI	1.67					
HTI	0.90	1.30	1.45	1.43–1.46	1.30	1.21–1.46
AI	1.68	1.49	1.65	1.62–1.68	1.63	1.55–1.68
SCI	1.57	1.33	1.22	1.21–1.23	1.33	1.16–1.23
WI1			7.50	7.46–7.55	6.94	6.27–7.55

and pointed. Frontal carinae short, almost straight and curve outwards to merge into rugae which surround antennal sockets; although antennal scape appearing slender and long, it distinctly shorter than head; 3rd–5th funicular joints about 1.5 times longer than broad. In profile, pronotum feebly convex, mesonotal dorsum appearing concave and mesonotum curves down abruptly to propodeum to form distinct, wide and deep mesopropodeal furrow. Propodeal spines long, thin, straight, relatively narrow at their bases, and projected backwards and upwards at about 45? Petiole with long anterior peduncle and in appearing relatively high, its anterior surface concave and meets more or less straight posterior surface to form truncated node, postero-dorsal surface of node appearing as tight arch (or on some specimens can appearing somewhat ungulate). Postpetiole subcubical, its anterior and dorsal surfaces meet to form regular arch, apex of which slightly anterior to mid point.

Head dorsum (including clypeus) coarsely, longitudinally rugose, central frons with < 13 rugae; surfaces between rugae, and frontal area appearing smooth and shiny. Promesonotal dorsum coarsely, irregularly rugoso-reticulate, propodeal dorsum longitudinally rugose and sides of alitrunk coarsely, longitudinally rugose. Petiole and postpetiole with sinuous, longitudinal rugae; their surfaces appearing smooth and shiny. Body with long, thin, erect to suberect hairs; those of lateral margins of head and appendages decumbent. Body generally dark reddish, legs and antennae dark reddish-brown.

Females. Generally like workers in shape of head, sculpture, coloration and pilosity except: antennal scape relatively shorter, propodeal spine relatively much shorter and broader at their bases, they project backwards rather than upwards. Although general shape of petiole (seen in profile) similar to that of workers, posterior surface distinctly steeper so that general shape of node appearing more domed and less subtriangular. Scutum, scutellum, sides of alitrunk, petiole and postpetiole coarsely longitudinally rugose with surface between rugae appearing smooth and shiny. General colour dark reddish-brown.

Males. Head elongate, somewhat narrowed anteriorly, with slightly convex sides and occipital margins, and rounded occipital corners. Anterior clypeal margin slightly prominent and narrowly rounded medially. Antennal scapes long and very feebly curved at their bases. Masticatory margin of mandibles distinct, with 5 small acute tooth and longer apical one. Alitrunk long and wide; in profile scutum appearing feebly convex and propodeum with short, blunt denticles; metapleural lobes rounded. Petiole with short, thick but distinct anterior peduncle; its anterior surface seen in profile, slightly concave and posterior one convex, dorsum of node relatively long and feebly convex, so that petiole length distinctly exceeding its height. Postpetiole subglobular.

Central part of head dorsum with convergent rugosity, and sides with sinuous, longitudinal rugae; surfaces between rugae finely punctured and appearing submatte. Clypeus with reduced longitudinal striation and appearing shiny; frontal area finely superficially punctured but appearing more or less smooth. Scutellum and central part of distal half of scutum longitudinally rugose; pro- and mesopleura finely longitudinally striated; sides of propodeum longitudinally rugose. Sides of petiolar node finely longitudinally striate, otherwise surfaces of both petiole and postpetiole appearing shiny (no punctures). Occipital and lateral margins of head with relatively long, abundant, suberect hairs; alitrunk, petiole, postpetiole and gaster with sparser, shorter, straight, suberect hairs; legs and scapes with short, decumbent hairs. General colour reddish-brown and head dark brown.

Notes. The workers and females of *M. rhytida* differ from *M. wardi, M. ordinaria* and *M. cachmiriensis* by the distinctly more coarse rugosity of head dorsum, alitrunk, petiole and postpetiole. The males differ from *M. wardi* and *M. cachmiriensis* by their long antennal scape (males of *M. ordinaria* are unknown). A little is known about its ecology. It is fairly common at altitudes from 3130 and 4200 m. In Kashmir (P. Ward,

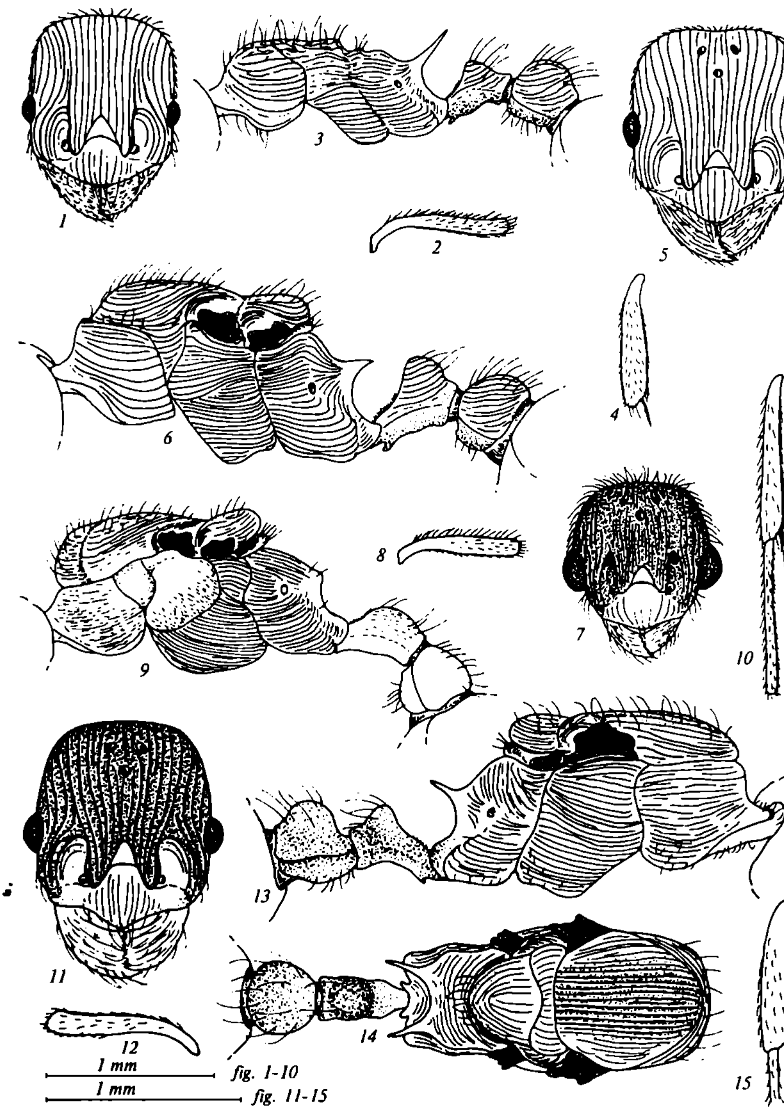


Fig. 5. Details of structure of *Myrmica rhytida* (*1–4* — worker, holotype, *5, 6* — female, paratype, *7–10* — male, paratype) and *M. petita* (*11–15* — female, holotype): *1, 5, 7, 11* — head, frontal view; *2, 8, 12* — antennal scape; *3, 6, 9, 13* — alitrunk and waist in profile; *4, 10, 15* — hind tibia.; *14* — alitrunk and waist from above.

Рис. 5. Детали строения *Myrmica rhytida* (*1–4* — рабочий, голотип, *5, 6* — самка, паратип, *7–10* — самец, паратип) и *M. petita* (*11–15* — самка, голотип): *1, 5, 7, 11* — голова спереди; *2, 8, 12* — скапус антенн; *3, 6, 9, 13* — грудь и стебелек в профиль; *4, 10, 15* — задняя голень; *14* — грудь и стебелек сверху.

pers. comm.) it was found in the same regions as *M. wardi* but at a higher altitude (mean 3600 m *v* 2700 m) where it nested in the soil (often under stones) and in birch logs, in alpine meadows often containing juniper species, and at the edges of birch forests at an altitude where rhododendrons begin to appear. Ward found it tending root aphids in several of its nests and its foraging behaviour is quite cryptic, it stays close to the soil surface and was never found foraging on plants. In this respect it behaviour is reminiscent of that of the northern European forms of *Myrmica lobicornis* Nylander.

Myrmica petita Radchenko & Elmes, **sp. n.** (fig 5, *11–15*)

Material. Holotype female, [India], Kashmir, Yusmar, 2300–2400 m, 6.07.1976, leg. W. Wittmer (NHMB).

Female. Head relatively long, with very feebly convex sides, straight occipital margins and narrowly rounded occipital corners; anterior clypeal margin narrowly rounded and pointed. Frontal carinae short, weakly curved, curving outwards to merge with rugae which surround antennal sockets. Antennal scape weakly curved at base (not angled) with no trace of lobe. Alitrunk relatively long and wide; propodeal spines projected backwards, relatively long, thin and sharp, and slightly broadened at their bases. Petiole with relatively long anterior peduncle. In profile, its anterior surface concave and node appearing subtriangular with narrowly rounded dorsum. Postpetiole appearing subspherical and somewhat higher than wide.

Head dorsum longitudinally rugose and surfaces between rugae densely but not coarsely punctured, appearing more or less dull; clypeus longitudinally rugose but not punctured; frontal area smooth and shiny; mandibles densely longitudinally striated. Scutum densely longitudinally rugulose and surfaces between rugae (exception for lateral parts) densely but not coarsely punctured; scutellum with finer rugulosity and surfaces between rugae smooth and shiny; sides of alitrunk densely but not coarsely longitudinally rugulose, with no punctures. Petiole with fine punctures and postpetiole with even finer punctures, but they appearing more or less shiny. Ventral and occipital margins of head with no hairs (only microscopic decumbent pilosity) but cheeks with few long setae; alitrunk dorsum with sparse, more or less straight, erect to suberect hairs; petiole and postpetiole with longer hairs; scapes and legs with short decumbent to subdecumbent pilosity. Entire body and appendages very dark reddish-brown colour.

Notes. The workers and males are unknown. The ecology is not known. This female of *M. petita* is unusually small (see table 4); it is probably smaller than the queens of all known free-living *Myrmica* species, and differs in this respect from all the other females of *Myrmica* recorded from the Himalaya. The smallest females of certain parasitic species, for example *M. microrubra* Seifert, can have a similar small stature but these usually appear to be intercastes with workers and seldom have the fully developed thorax and wings of this specimen (Elmes, *unpubl. data*). We can not rule out the possibility that it is a social parasite, but we consider that its general lack of "parasitic" characters (e. g. reduced pectinate spurs, ventral lobes to the petiole and postpetiole, relatively wide postpetiole and general hairiness) suggests that it is a free-living species. In which case, it most resembles morphologically, the workers of *M. wittmeri* (described above) which also has exceptionally small workers and an unknown female caste. It differs from *M. wittmeri* workers only by the punctured surface of its head dorsum, and relatively longer propodeal spines. It is not unusual for the sculpture of the heads of *Myrmica* females to be "coarser" than that of their workers; however, we know of no *Myrmica* species where the epinotal spines of the females are relatively longer than those of their workers. Therefore, we considered it best to describe this female as a new species, *M. petita*, which is probably very close to *M. wittmeri*.

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